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Toshiyuki Miyauchi

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03/11/2005

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EXAMINER

TORRES, JOSEPH D

ART UNIT

PAPER NUMBER

2133

DATE MAILED: 03/11/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

**Application No.**

09/876,742

**Applicant(s)**

MIYAUCHI ET AL.

**Examiner**

Joseph D. Torres

**Art Unit**

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 04 January 2005.  
2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.  
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-13 and 49-61 is/are pending in the application.  
4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.  
5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.  
6) ☒ Claim(s) 1-13 and 49-61 is/are rejected.  
7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.  
8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.  
10) ☒ The drawing(s) filed on 11 August 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☒ All b) ☐ Some \* c) ☐ None of:  
1. ☒ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)  
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)  
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.  
4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_.  
5) ☐ Notice of Informal Patent Application (PTO-152)  
6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Claim Rejections - 35 USC § 112*

1. In view of the Applicant's Amendment filed 11 August 2004, The Examiner withdraws all previous 112 rejections to the claims.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1-13 and 49-61 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 1 recites new matter: "concurrent operations of addition, comparison and selection in log likelihood computations". Claim 48 recites new matter: "concurrent operations of addition, comparison, and selection in log likelihood computations".

The Examiner asserts that the Applicant's Figures 14, 15, 17, etc. teach that selection takes place after addition and comparison since the selectors in Figures 14, 15, 17, etc. require the results of the adder and comparison units; hence selection cannot occur concurrently with the operations of comparison and addition in the log likelihood computations taught in the applicant's disclosure.

***Response to Arguments***

3. Applicant's arguments with respect to claims 1-6, 9, 10, 12, 13, 49-54, 57, 58, 60 and 61 have been considered but are moot in view of the new ground(s) of rejection.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

4. Claims 1-3 and 49-51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Van Stralen, Nick Andrew et al. (US 6304996 B1, hereafter referred to as Van Stralen) in view of Yamanaka; Ryutaro et al. (US 6330684 B1).

35 U.S.C. 103(a) rejection of claims 1 and 49.

Van Stralen teaches a first probability computing means for computing a logarithm of branch metric  $\gamma$ , which is a logarithm of probability of a particular branch of a Trellis

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diagram, computed only based on the knowledge of input and output symbols associated with the particular branches (Figure 7 and col. 2, lines 36-38 in Van Stralen teaches a first probability computing means for computing a logarithm of branch metric  $\gamma$ , which is a logarithm of probability of a particular branch of a Trellis diagram, computed only based on the knowledge of input and output symbols associated with the particular branches; Note: col. 5, lines 42-61 in Van Stralen teach that branch metrics  $\gamma$  are converted to logarithms for computational purposes); a second probability computing means for computing a logarithm of forward state metric  $\alpha$ , which is a logarithm of probability of a particular state of the Trellis diagrams given the probabilities of states at previous time instances (Figure 4a and col. 2, lines 17-19 in Van Stralen teaches a second probability computing means for computing a logarithm of forward state metric  $\alpha$ , which is a logarithm of probability of a particular state of the Trellis diagrams given the probabilities of states at previous time instances); a third probability computing means for computing a logarithm of backward state metric  $\beta$ , which is a logarithm of probability of the particular state of the Trellis diagram, given the probabilities of states at future time instances, wherein each of said second probability computing means (Figure 4b and col. 2, lines 20-22 in Van Stralen teaches a third probability computing means for computing a logarithm of backward state metric  $\beta$ , which is a logarithm of probability of the particular state of the Trellis diagram, given the probabilities of states at future time instances, wherein each of said second probability computing means) and said third Probability computing means includes a path selection means said path selection means including: a plurality of comparator circuits, a plurality

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of absolute value computation circuits, a plurality of selectors to select at least two paths to a state in the Trellis diagram from at least three paths, said plurality of selectors configured to enable operations of addition, comparison and selection in log likelihood computations (Figure 5a in Van Stralen teaches a plurality 2 Sums & Log-Addition circuits 66, each 2 Sums & Log-Addition circuits 66 depicted in Figure 5B comprising Adders 70, 71, 74 and 75 providing outputs to logarithmic adder 76 in Figures 5B and 5C, each logarithmic adder 76 in Figures 5B comprising comparator 78 and selector 79; Note: Figure 5A is a means for selecting sigma posteriori probabilities which provide path likelihood information for surviving paths); and a soft-output determining means for determining a log soft-output logarithmically expressing a soft-output in each time slot, given said forward and backward state metrics as well as said branch metric (the Abstract in Van Stralen teaches that sigma values are used to provide soft-decision outputs; col. 8, lines 20-45 in Van Stralen teaches that sigma values are based on alpha and Beta metrics).

However Van Stralen does not explicitly teach the specific use of concurrent operations of addition, comparison prior to selection in log likelihood computations. Yamanaka, in an analogous art, teaches use of concurrent operations of addition, comparison prior to selection in log likelihood computations (see Figure 9 in Yamanaka).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Van Stralen with the teachings of Yamanaka by including an additional step of use of concurrent operations of addition, comparison prior to

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selection in log likelihood computations. This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that use of concurrent operations of addition, comparison prior to selection in log likelihood computations would have provided the opportunity for efficiently processing an ACS operation of the Viterbi decoding by use of DSP with a small investment in software (col. 1, lines 54-57 in Yamanaka).

35 U.S.C. 103(a) rejection of claims 2 and 50.

Comparator 78 in Figure 5C of Van Stralen is comparison means for comparing the likelihoods of all the combinations of two paths selected from all the three or more than three paths getting to each state (Note: Figure 5C is a block diagram of the Log Addition circuits 67 in Figure 5A of Van Stralen). Also see col. 9, lines 10-22 of Van Stralen for details.

35 U.S.C. 103(a) rejection of claims 3 and 51.

Absolute Value circuit 106 in Figure 8A in Van Stralen is an absolute value selection means for selecting the absolute value of the difference between the data corresponding to the maximum likelihood path and the data corresponding the second maximum likelihood path.

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5. Claims 4, 5, 52 and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Van Stralen, Nick Andrew et al. (US 6304996 B1, hereafter referred to as Van Stralen) and Yamanaka; Ryutaro et al. (US 6330684 B1) in view of Benedetto et al. (S. Benedetto, D. Divsalar, G. Montorsi, and F. Pollara, Soft-Output Decoding Algorithms in Iterative Decoding of Turbo Codes, TDA Progress Report 42-124, NASA Code 315-91-20-20-53).

35 U.S.C. 103(a) rejection of claims 4 and 52.

Van Stralen and Yamanaka, substantially teaches the claimed invention described in claims 1-3, 14, 25-27 and 38 (as rejected above). In addition, Absolute Value circuit 106 in Figure 8A in Van Stralen is an absolute value selection means having an absolute value computing means for computing the absolute value of the difference of each of all the combinations of two paths selected from all the three or more than three paths getting to each state. Comparator 78 in Figure 5C of Van Stralen is a means for comparing the magnitude of the computed values

However Van Stralen and Yamanaka, does not explicitly teach the specific use of the computed absolute values being compared for magnitude on the basis of the information on the outcome of comparison obtained by comparing the likelihood of each of all the combinations of two paths selected from all the three or more than three paths getting to each state by means of said path selection means.

Benedetto et al. (hereafter referred to as Benedetto), in an analogous art, teach that both Approximation Algorithms 1 and 2 require comparison steps for the absolute value

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(Page 86 of Benedetto; Note in Approximation 1, the absolute value,  $x$ , is compared to 0 and  $b/a$  and in Approximation 2, the absolute value,  $x$ , is compared to  $\eta$ ). One of ordinary skill in the art at the time the invention was made would have been highly motivated to employ the approximation methods in the Benedetto paper to simplify the calculation to the log likelihood term required by the MAP algorithm.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Van Stralen and Yamanaka with the teachings of Benedetto by including use of the computed absolute values being compared for magnitude. This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that use of the computed absolute values being compared for magnitude would provide the opportunity to simplify the calculation of the log likelihood term required by the MAP algorithm.

35 U.S.C. 103(a) rejection of claims 5 and 53.

Note: Approximation Algorithm 1 in Benedetto is a linear approximation means computing by linear approximation a correction term added to obtain said log likelihood and expressed by a one-dimensional function relative to a variable and the variable,  $x$ , is the absolute value of the difference between the data corresponding to said maximum likelihood path and fed from said absolute value selection means and the data corresponding to said second maximum likelihood path (Page 86 of Benedetto).

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6. Claims 6, 9, 10, 12, 13, 54, 57, 58, 60 and 61 are rejected under 35 U.S.C. 103(a) as being unpatentable over Van Stralen, Nick Andrew et al. (US 6304996 B1, hereafter referred to as Van Stralen), Yamànaka; Ryutaro et al. (US 6330684 B1) and Benedetto et al. (S. Benedetto, D. Divsalar, G. Montorsi, and F. Pollara, Soft-Output Decoding Algorithms in Iterative Decoding of Turbo Codes, TDA Progress Report 42-124, NASA Code 315-91-20-20-53) in view of XP-000888685 ("Simplified Log-Map Algorithm", Research Disclosure, Kenneth Mason Publications, Hampshire, GB, No. 421, May 1999, Page 612, ISSN: 0374-4353: Note this publication was provided by the Applicant in US Application 09/875310).

35 U.S.C. 103(a) rejection of claims 6 and 54.

Van Stralen, Yamanaka and Benedetto et al. (hereafter referred to as Benedetto), substantially teaches the claimed invention described in claims 1-5, 14-29 and 38-48 (as rejected above). In addition, Benedetto teaches a decoder for determining the log likelihood logarithmically expressing the probability of passing a given state on the basis of the received value regarded as soft-input and decoding the input by using the log likelihood (the Abstract, Appendix and Figures 6, A-1 and A-2 in Benedetto teach a decoder for determining the log likelihood logarithmically expressing the probability of passing a given state on the basis of the received value regarded as soft-input and decoding the input by using the log likelihood), said decoder comprising: a linear approximation means for calculating a correction term to be added to the log likelihood (Approximation 1 on page 86 of Benedetto teaches a linear approximation means, -

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$ax+b$ , for calculating a correction term to be added to the log likelihood), the correction term being expressed in a one-dimensional function relative to a variable (in

Approximation 1 on page 86 of Benedetto,  $-ax+b$  is a one-dimensional function relative to the variable  $x$ ); and said linear approximation means being adapted to compute said correction term using a coefficient representing the gradient of said function for multiplying said variable (see Approximation 1 on page 86 of Benedetto; Note:  $a$  represents the one-dimensional gradient of the function,  $-ax+b$ ).

However Van Stralen, Yamanaka and Benedetto, do not explicitly teach the specific use of the coefficient being expressed as a power exponent of 2.

Document XP-000888685, in an analogous art, teaches that  $B = 4 = 2^2$ , hence  $a$  in Benedetto  $= 2^{-2}$  since  $a$  in Benedetto  $= 1/B$ . Document XP-000888685 provides explicit motivation for combining stating that "... $B = 4$  achieves performance that is very close to exact implementation".

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Van Stralen, Yamanaka and Benedetto with the teachings of Document XP-000888685 by including use of the coefficient being expressed as a power exponent of 2. This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that use of the coefficient being expressed as a power exponent of 2 would have provided the opportunity to achieve performance that is very close to exact implementation (see the last paragraph of the first page of Document XP-000888685).

35 U.S.C. 103(a) rejection of claims 9, 10, 57 and 58.

Selection of a particular value for  $b$  in the equation,  $-ax+b$ , is a particular embodiment of the equation, hence does not deviate from the scope or intent of the teachings in the Benedetto paper.

35 U.S.C. 103(a) rejection of claims 12 and 60.

$|x-y|$  in the equation  $A - (|x-y|/B)$  of Document XP-000888685 is a positive value, hence Document XP-000888685 teaches said correction term shows a positive value. Note also, this is consistent with the Benedetto paper since the Benedetto paper requires  $x > 0$ .

35 U.S.C. 103(a) rejection of claims 13 and 61.

Document XP-000888685 teaches  $(A - (|x-y|/B))_+ = A - (|x-y|/B)$  when  $A - (|x-y|/B) > 0$  and  $(A - (|x-y|/B))_+ = 0$  when  $A - (|x-y|/B) \leq 0$ .

### ***Conclusion***

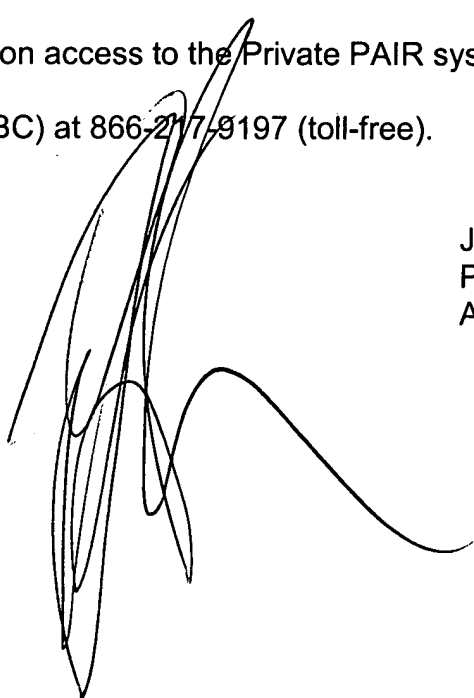
Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Joseph D. Torres whose telephone number is (571) 272-3829. The examiner can normally be reached on M-F 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Albert Decady can be reached on (571) 272-3819. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Joseph D. Torres, PhD  
Primary Examiner  
Art Unit 2133